Scopus

Documents

Korzhova, V.N., Goldgof, D.B., Sisoev, G.M.

Model-based recovery of fluid flow parameters from video
(2011) *International Journal of Pattern Recognition and Artificial Intelligence*, 25 (3), pp. 309-336.

Abstract
This paper develops a novel approach for fluid flow tracking and analysis. Specifically, the proposed algorithm is able to detect the traveling waves, compute the wave parameters and determine controlling film flow parameters for a liquid film flowing over a rotating disk. The input to the algorithm is an easily acquired video data. It is shown that under single light illumination, it is possible to track the specular portion of the reflected light on the traveling wave. Hence, wavy films can be tracked, and fluid flow parameters can be computed. The fluid flow parameters include wave velocities, wave inclination angles, and distances between consecutive waves. Once the parameters are computed, their accuracy is analyzed and compared with the solutions of the mathematical models based on the NavierStokes equations. The mathematical model predicts wave characteristics based on directly measured controlling parameters, such as disk rotation speed and fluid flow rate. It is shown that the calculated parameter values coincide with the predicted ones. The average computed parameters are within 510% of the predicted values. Next, the developed approach is generalized to model-based recovery of fluid flow controlling parameters: the rotation speed and the fluid-flow rate. The search in space for model parameters is performed to minimize the error between the flow characteristics predicted by the fluid dynamics model (e.g. distance between waves, wave inclination angles) and parameters recovered from video data. Results demonstrate that the speed of a disk and the flow rate, when compared to the ground truth available from direct observation, are recovered with the error less than 10%. © 2011 World Scientific Publishing Company.

2-s2.0-79957603754
Document Type: Article
Publication Stage: Final
Source: Scopus